

WHAT IS CLAIMED IS:

1. A throughdrying process for the manufacture of a tissue web, comprising:

conveying a moving fibrous web of cellulose fibers in a throughdrying system, including conveying the web through at least one throughair drying station;

5 supplying the throughair drying station with a heated drying medium from a source, the heated drying medium passing through and drying the fibrous web, the drying medium being conducted from the throughair drying station as moisture laden exhaust air;

10 collecting and drying the moisture laden exhaust air from the throughair drying station; and

recirculating at least a portion of the dried exhaust air back to the throughair drying station as a supplement to the source of heated drying medium, thereby reducing the load on the heated drying medium source.

2. The process as in claim 1, wherein the throughair drying station includes a single throughair dryer.

3. The process as in claim 1, wherein the throughair drying station includes at least two serially arranged throughair dryers, the exhaust air being collected and recirculated from and to the serially arranged throughair dryers.

4. The process as in claim 1, wherein the exhaust air is dried by being conveyed through a fluidized bed of drying particles that absorb the moisture from the exhaust air.

5. The process as in claim 4, wherein odors are removed from the exhaust air as it is dried.

6. The process as in claim 5, wherein odor absorbing particles are mixed with the drying particles in the fluidized bed.

7. The process as in claim 4, wherein the heated drying medium is supplied from a fuel burning burner.

8. The process as in claim 7, wherein the recirculated dried exhaust air is mixed with the heated drying medium from the burner prior to being supplied to the throughair drying station.

9. The process as in claim 4, wherein the drying particles are removed from the recirculated dried exhaust air prior to the exhaust air being supplied to the throughair drying station.

10. The process as in claim 9, wherein the drying particles removed from the exhaust air are regenerated and recirculated back to the fluidized bed.

11. The process as in claim 10, wherein at least a portion of the heated drying medium is used to regenerate the drying particles by heating the particles in a heat exchanger prior to the drying medium being supplied to the throughair drying station.

12. The process as in claim 11, wherein the heated drying particles are cooled prior to being recirculated back to the fluidized bed.

13. The process as in claim 12, wherein the heated drying particles are cooled with a supply of atmospheric air, the heated atmospheric air from the cooling process in turn being supplied as intake air to the heated drying medium source.

14. The process as in claim 11, wherein the drying particles are also regenerated by direct contact with a supply of atmospheric air that adsorbs moisture from the heated drying particles.

15. The process as in claim 14, wherein the moisture laden atmospheric air from regeneration of the drying particles is conveyed away from said throughdrying system for other process applications.

16. The process as in claim 15, wherein the moisture laden atmospheric air from regeneration of the drying particles is compressed prior to use in the other process applications.

17. The process as in claim 1, further comprising removing odors from the dried exhaust air.

18. The process as in claim 17, wherein odors are removed by conveying the dried exhaust air through a fluidized bed of odor absorbing particles.

19. A throughdrying process for the manufacture of a tissue web, comprising:

conveying a moving fibrous web of cellulose fibers in a throughdrying system, including conveying the web through at least one throughair drying station;

- 5 supplying the throughair drying station with a heated drying medium from a burner, the heated drying medium passing through and drying the fibrous web and being conducted from the throughair drying station as moisture laden exhaust air; conveying the moisture laden exhaust air from the throughair drying station through a drying bed of a moisture absorbing substrate;
- 10 recirculating at least a portion of the dried exhaust air back to the throughair drying station to supplement the heated drying medium from the burner; and regenerating the moisture absorbing substrate with at least a portion of the heated drying medium from the burner.

20. The process as in claim 19, wherein the drying bed contains particles for the moisture absorbing substrate that are fluidized by passage of the moisture laden exhaust air therethrough.

21. The process as in claim 20, further comprising separating the particles of moisture absorbing substrate from the dried exhaust air prior to said regenerating step.

22. The process as in claim 19, wherein the moisture absorbing substrate is cooled with a supply of air after being heated by the heated drying medium.

23. The process as in claim 22, wherein the supply of air is heated by the process of cooling the moisture absorbing substrate, and is conveyed to an intake of the burner.

24. A throughdrying system for the manufacture of a tissue web, comprising:

- a throughair drying station through which a moving fibrous web of cellulose fibers is conveyed;
- 5 a source configured to supply a heated drying medium to said throughair drying station that dries the web, said drying medium being exhausted from said throughair drying station as moisture laden exhaust air; and
- a closed-loop recirculation path for at least a portion of said moisture laden exhaust air to be mixed with said heated drying medium, said recirculation
- 10 path further comprising a dryer that removes moisture from said moisture laden exhaust air.

25. The system as in claim 24, wherein said throughair drying station comprises a single throughair dryer.

26. The system as in claim 24, wherein said throughair drying station comprises at least two serially arranged throughair dryers, moisture laden exhaust air being collected from and recirculated to said serially arranged throughair dryers.

27. The system as in claim 24, wherein said dryer comprises a fluidized bed of drying particles through which said moisture laden exhaust air is conveyed.

28. The system as in claim 27, wherein said fluidized bed further comprises odor absorbing particles.

29. The system as in claim 27, further comprising a separating station in said recirculation path downstream of said dryer and configured to remove said drying particles from said exhaust stream.

30. The system as in claim 29, wherein said separating station comprises at least one cyclone separator.

31. The system as in claim 30, wherein said separating station comprises a coarse cyclone separator and a fine cyclone separator.

32. The system as in claim 29, further comprising a regeneration loop configured to receive said drying particles from said separating station, said regeneration loop comprising a heating device through which said drying particles are conveyed and heated to release moisture therefrom, said regeneration loop
5 returning said drying particles to said fluidized bed.

33. The system as in claim 32, wherein said heating device comprises a heat exchanger supplied with at least a portion of said heated drying medium.

34. The system as in claim 33, wherein said heat exchanger is also supplied with a source of atmospheric air that is conveyed in direct contact with said drying particles to remove moisture released therefrom.

35. The system as in claim 34, further comprising an exhaust line from said heat exchanger that directs moisture laden atmospheric air to other process applications.

36. The system as in claim 35, wherein said exhaust line comprises a compressor.

37. The system as in claim 32, wherein said regeneration loop further comprises a cooling device downstream of said heating device wherein said drying particles are cooled prior to being returned to said fluidized bed.

38. The system as in claim 37, wherein said cooling device comprises a heat exchanger supplied with atmospheric air.

39. The system as in claim 38, wherein heated atmospheric air from said cooling device is supplied as intake air to said heated drying medium source.

40. The system as in claim 24, wherein said heated drying medium source comprises a burner.

41. The system as in claim 40, wherein said recirculated dried exhaust air is mixed with said heated drying medium from said burner prior to being supplied to said throughair drying station.